Experimental testing of wave energy converters for the WECfarm project

De Witte Bono[1], Claerbout Hendrik[1], Timothy Vervaet[1], Vasiliki Stratigaki[1], Peter Troch[1]

[1] Department of Civil Engineering, Ghent University, Technologiepark 60, 9052, Ghent, Belgium
E-mails: Bono.DeWitte@UGent.be; Hendrik.Claerbout@UGent.be; timothy.vervaet@UGent.be
vicky.stratigaki@UGent.be; peter.troch@UGent.be;

This abstract refers to an ongoing Master Thesis, conducted by Bono the Witte and Hendrik Claerbout, at the department of Civil Engineering of Ghent University (Belgium) on the optimal geometric configuration of multiple WECs in a WEC array. A new experimental campaign within the WECfarm project is planned in a new wave basin which has been constructed in Ostend, Belgium; the Coastal & Ocean Basin (COB). WECfarm will deliver a database for validation of new advanced numerical models which are worldwide employed for WEC array modelling. At the time of the 3rd Online WECANet General Assembly (November 2020), dry-testing takes place at Ghent University of one single WEC. The importance of dry-testing is to check the proper working of all mechanic, electronic and control aspects before deploying the WEC in a wave flume or wave basin.

The working principle of the WEC is the one of a point absorber operating in heave. The power take-off consists of a rack and pinion system in combination with a rotational Permanent-Magnet Synchronous Motor (PMSM). To control the WEC, a Simulink 'Real Time torque control' model is used. This model is built on a development computer and subsequently loaded on a Speedgoat Performance real-time target machine. In this context, real-time is the capability of the algorithm to execute within a prescribed update rate. The input of the control model consists of the position, velocity, acceleration of the buoy and the vertical force on the buoy. These are obtained with a laser sensor, motor encoder, accelerometer and configuration of three loads cells, respectively. The output of the control model is the torque to deliver to the motor.

Within the present Master Thesis a single WEC is scheduled to be tested at the wave basin of Aalborg University, as part of the WECfarm collaboration with Aalborg University, Denmark (dr. Francesco Ferri). The test matrix will contain diffraction tests, radiation tests and power absorption tests. It will also contain (extreme) wave conditions to induce non-linear effects. If possible within the timeframe of this Master Thesis (to be completed by June 2021), a second WEC will be constructed which will be identical to the first one that is currently tested. Following that, an array of two WECs will be firstly dry-tested and secondly tested in the wave flume at Ghent University with a focus on interaction and control strategy. These steps will allow us to make recommendations for the WEC array experimental set-up where up to five WECs will be employed, which will be experimentally tested at COB wave basin in 2022.

COST is supported by the EU Framework Programme Horizon 2020. COST (European Cooperation in Science and Technology) is a funding agency for research and innovation networks. COST Actions help connect research initiatives across Europe and enable scientists to grow their ideas by sharing them with their peers.

During the present Master Thesis, there is close collaboration with other Master Thesis work at Ghent University focusing on control strategies and on the testing of one single WEC in order to fully characterize the hydrodynamic performance of the WEC. The obtained dataset of the 3D testing of the first WEC at the wave basin of Aalborg University will serve as input for numerical model validation that is currently taking place at Ghent University based on Smoothed Particle Hydrodynamics methods.

This research situates itself in the topics of the WECANet Working Group 2, “Experimental hydrodynamic modelling and testing of WECs, WEC arrays/farms, PTO systems and field”.

Acknowledgements:
This work is supported by the the FWO (Fonds Wetenschappelijk Onderzoek - Research Foundation Flanders), Belgium, through the following funding: Timothy Vervaet is Ph.D. fellow (fellowship 11A6919N); Vasiliki Stratigaki is a postdoctoral researcher (fellowship 1267321N) and has been also granted an ‘FWO Research Grant’ for constructing the WEC experimental set-up (FWO-KAN-DPA376).

wecanet

A pan-European Network for Marine Renewable Energy with a Focus on Wave Energy

BOOK OF ABSTRACTS

of the General Assembly 2020 (online event) of the WECANet COST Action CA17105

Editors:

- Vasiliki Stratigaki
- Matt Folley
- Peter Troch
- Evangelia Loukogeorgaki
- Moncho Gómez-Gesteira
- Aleksander Grm
- Lorenzo Cappietti
- Francesco Ferri
- Irina Temiz
- Constantine Michailides
- George Lavidas
- Milen Baltov
- Liliana Rusu
- Xenia Loizidou

Online | November 26-27, 2020

cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

ISBN: 9789080928107

COST is supported by the EU Framework Programme Horizon 2020. COST (European Cooperation in Science and Technology) is a funding agency for research and innovation networks. COST Actions help connect research initiatives across Europe and enable scientists to grow their ideas by sharing them with their peers.

wecanet
a pan-european network for marine renewable energy

Book of Abstracts of the General Assembly 2020 (online event) of the

WECANet COST Action CA17105:

A pan-European Network for Marine Renewable Energy with a Focus on Wave Energy

Edited by

**Vasiliki Stratigaki, Matt Folley, Peter Troch, Evangelia Loukogeorgaki,
Moncho Gómez-Gesteira, Aleksander Grm, Lorenzo Cappietti, Francesco Ferri,
Irina Temiz, Constantine Michailides, George Lavidas,
Milen Baltov, Liliana Rusu and Xenia Loizidou**

ISBN: 9789080928107

This publication is based upon work from the WECANet COST Action CA17105, supported by COST (European Cooperation in Science and Technology). Support is also provided by the FWO (Fonds Wetenschappelijk Onderzoek - Research Foundation Flanders), Belgium. Vasiliki Stratigaki is a postdoctoral researcher (fellowship 1267321N) of the FWO.

www.wecanet.eu

COST (European Cooperation in Science and Technology) is a funding agency for research and innovation networks. COST Actions help connect research initiatives across Europe and enable scientists to grow their ideas by sharing them with their peers. This boosts their research, career and innovation.

www.cost.eu

cost
EUROPEAN COOPERATION
IN SCIENCE & TECHNOLOGY

Funded by the Horizon 2020 Framework Programme of the European Union